MHD Model Results of Solar Wind Plasma Interaction with Mars and Comparison with MAVEN Observations. Y. J. Ma[1], C. T. Russell[1], A. F. Nagy[2], G. Toth[2], J. S. Halekas[3], J. E. P. Connerney[4], J. R. Espley[4], and P. R. Mahaffy[4], [1]Department of Earth and Space Sciences, UCLA, Los Angeles, CA, 90095, [2]Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI 48109, [3]Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242, [4]NASA Goddard Space Flight Center, Greenbelt, MD 20771

Introduction: The crustal remnant field on Mars rotates constantly with the planet, varying the magnetic field configuration interacting with the solar wind. It has been found that ion loss rates slowly vary with the subsolar longitude, anticorrelating with the intensity of the dayside crustal field source, with some time delay, using a time-dependent multispecies MHD model (Ma et al., 2014). In this study, we investigate in detail how plasma properties are influenced locally by the crustal field and its rotation. Model results will be compared in detail with plasma observations from MAVEN.

Approach: The time-dependent multi-species single-fluid MHD model [*Ma et al.*, 2014] includes four continuity equations to track the mass densities of the proton and three major ions in Martian ionosphere: O_2^+, O^+ and CO_2^+. All the ion species share the same velocity and temperature. The Mars-solar wind interaction is self-consistently calculated in the model by including the effects of the crustal magnetic field, ion-neutral collisions, and major chemical reactions.

We simulate a few days of plasma interaction using solar wind condition based on averaged SWIA (Solar Wind Ion Analyzer) observations in the solar wind during relative quite time. The rotation of the crustal field is included in the time-dependent simulation, and Mars rotation axis is set to match the real condition.

Model Results and Comparsion: We present model results along MAVEN orbit and compare them with observations from MAVEN plasma instruments such as magnetometer (MAG) as shown in Figure 1, SWIA, and Neutral Gas and Ion Mass Spectrometer (NGIMS). The MHD model results are used to provide a global context of the observations in terms to understand the observed magnetic field (see Figure 2) and other plasma properties as well as the effect of the local crustal field and its rotation.

References: [1] Ma, Y. et al. (2014), Geophys. Res. Lett.,41, 6563–6569, [2] Arkani-Hamed, J. (2001), J. Geophys. Res., 106, 23,197–23,208.

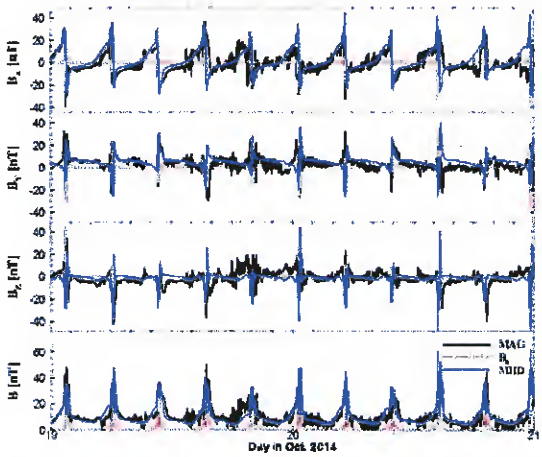

Figure 1: Comparsion of magnetic field components and strength with magnetometer data along MAVEN orbits between Oct 19, 2014 to Oct 21, 2014. The black lines are magnetometer data, the red lines are crustal field from Arkani-Hamed, J. (2001) and the blue lines are from model results.

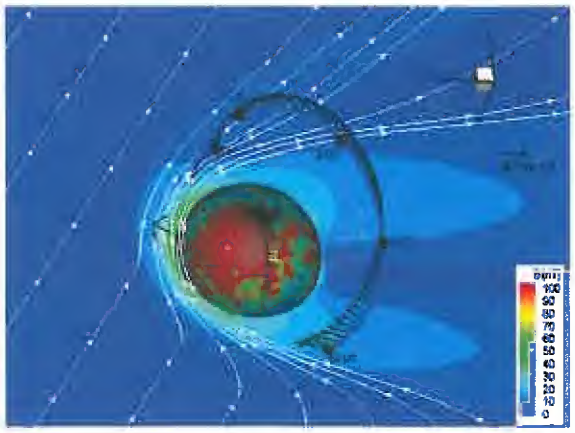

Figure 2: Global view of the plasma interaction around Mars from the South. Both the equatorial plane and MAVEN trajectory are colored with modeled magnetic field strength. The lines in the equatorial plane and arrows along the MAVEN orbit indicate magnetic field orientation from the MHD model. The corresponding date of the orbit is Oct. 19, 2014.